Contributions of Sediments to Lake Tahoe from Eroding Watersheds

Andrew Simon, Ron Bingner, Eddy Langendoen and Robert Wells

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National Sedimentation Laboratory

Issues

- Concerns over the clarity of Lake Tahoe from fine-grained/colloidal materials
- Previous anecdotal evidence that source could be channel materials
- Studies from a range of physiographic regions show that streambank materials are the dominant source of sediment in eroding channel systems

Approach for Lake Tahoe Watersheds

- Determine bulk loadings at 38 sites with historical flow and sediment-transport data (by size class).
- Perform RGA's at 300+ sites
- Determine upland loadings using AnnAGNPS
- Determine channel contributions using CONCEPTS (minimum of 3 streams) and direct comparison of measured sections
- Analyze modeled and historic data to determine what combination of watershed and channel conditions result in greatest loadings (prioritization of watersheds)

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Past and Future Loadings

DETERMINED USING:

1. **Historical Transport Data and Direct Comparisons(38 sites)**

2. **AnnAGNPS for Upland & Tributary Contributions** *(minimum of 3 watersheds)*

3. **CONCEPTS for Main Channels Contributions** *(minimum of 3 watersheds)*

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AGNPS OVERVIEW

- DEVELOPMENT OF WATERSHED BOUNDARIES FOR STREAMS, STREAM NETWORK, AND SUBDRAINAGE AREAS
- WATERSHED LANDUSE DESCRIPTION
- DEVELOPMENT OF AnnAGNPS WEATHER DATABASE
- PRODUCTION OF LOADINGS FOR USE WITH CONCEPTS
- IDENTIFY UPLAND SOURCES WITHIN THE WATERSHEDS
- DEVELOPMENT OF RECURRENCE INTERVALS FOR USE WITH THE DEVELOPMENT OF BACKGROUND CONDITIONS

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CONCEPTS Conservational Channel Evolution and Pollutant Transport System

Input:

- Channel geometry
- Composition of bed and bank materials
- Erosion resistance and shear strength of bed and bank materials
- Rates of flow and sediments entering the channel

Output:

- Changes in channel geometry
- Time series of hydraulic variables and sediment loads and concentrations

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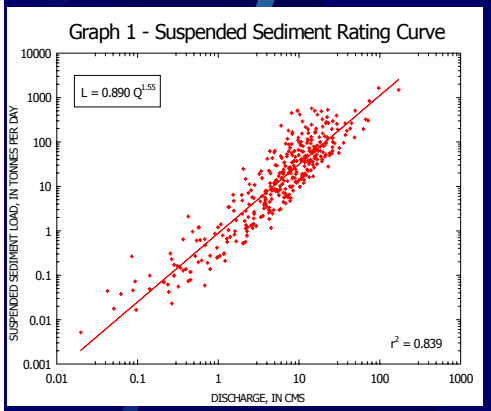
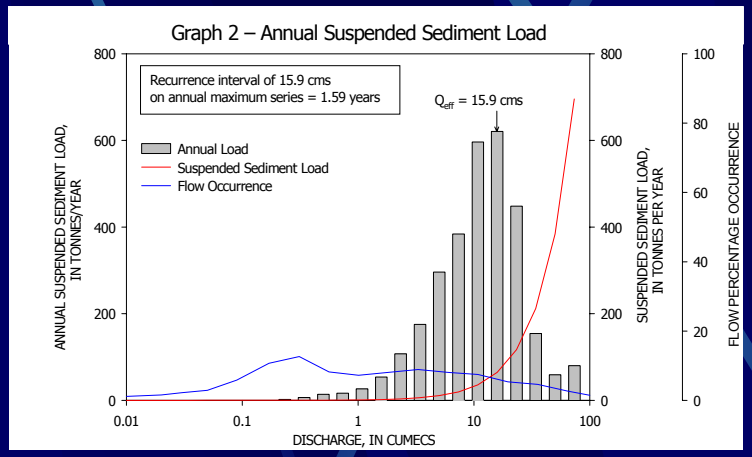
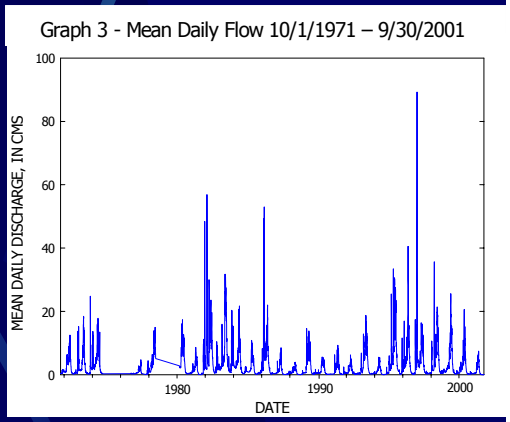
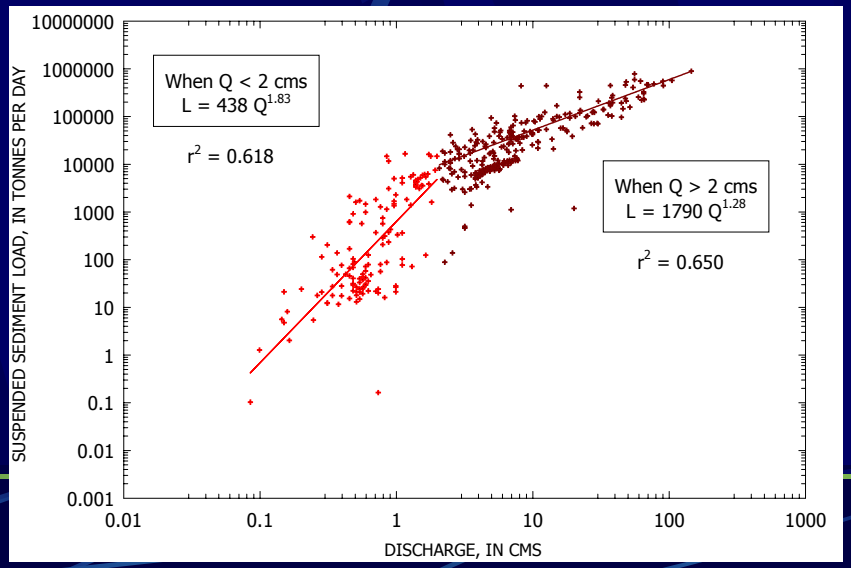
Obtaining Effectve Discharge to Compare Local and "Background" Transport Rates in the Sierra Nevada

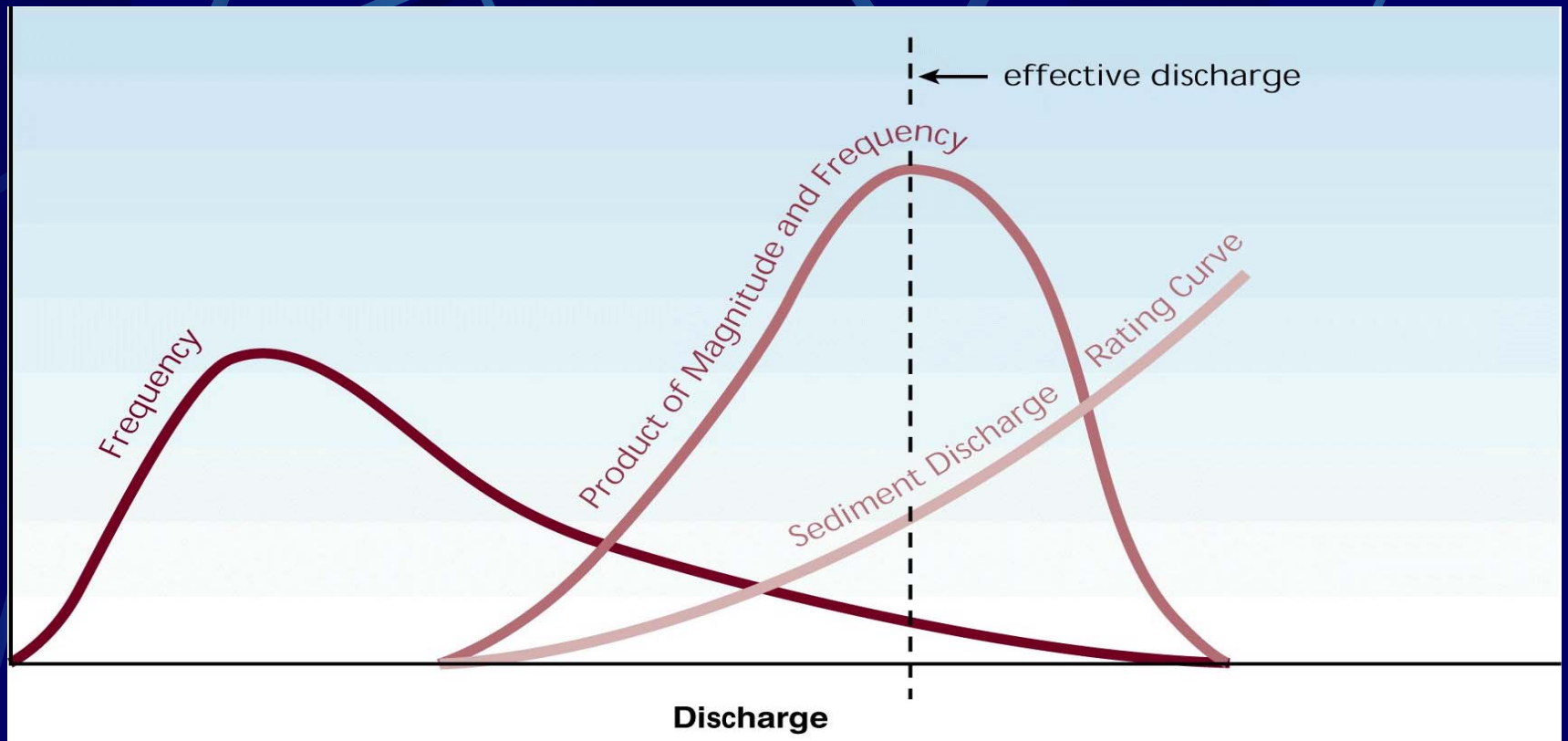








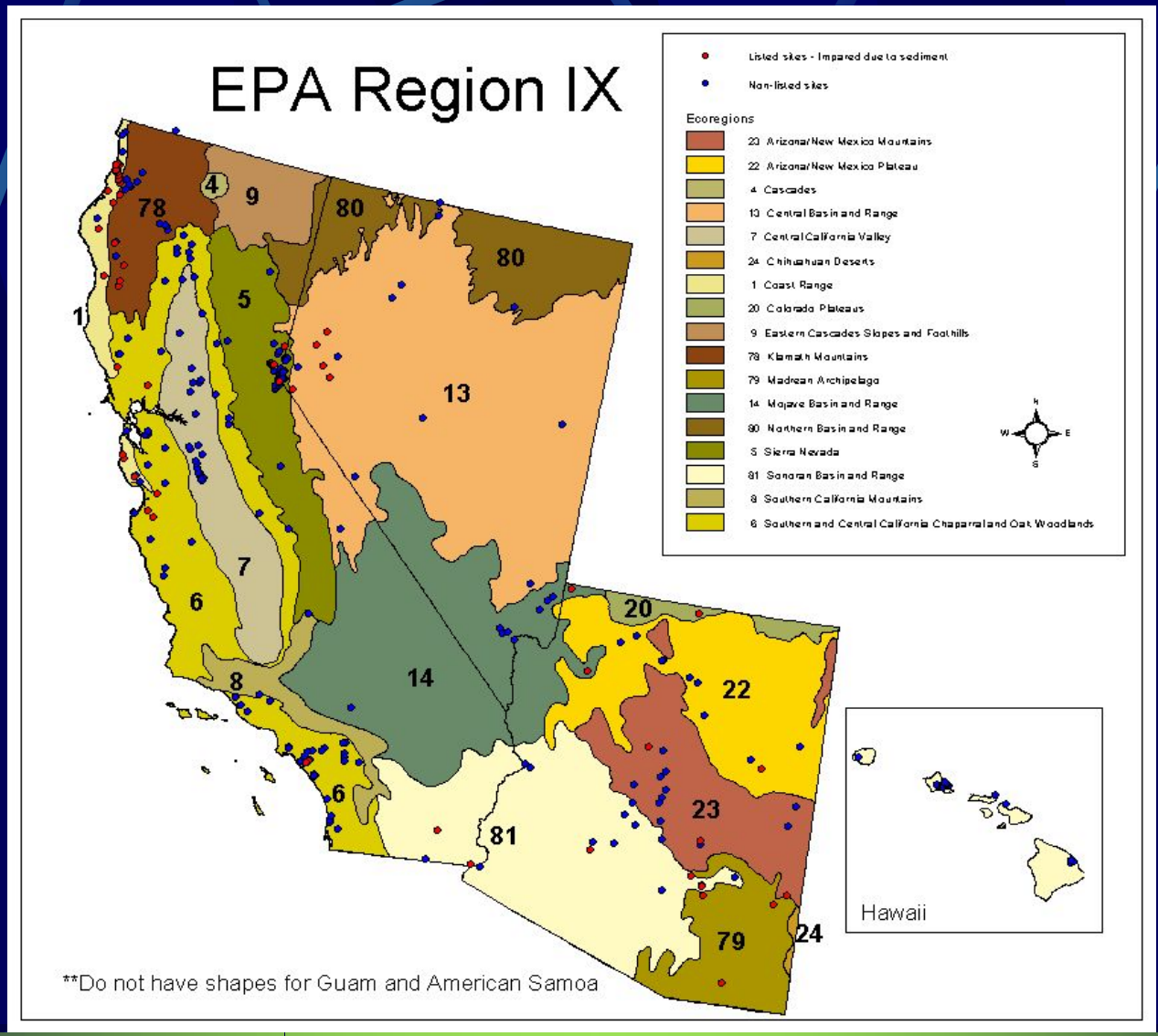
Definition Sketch of Effective Discharge



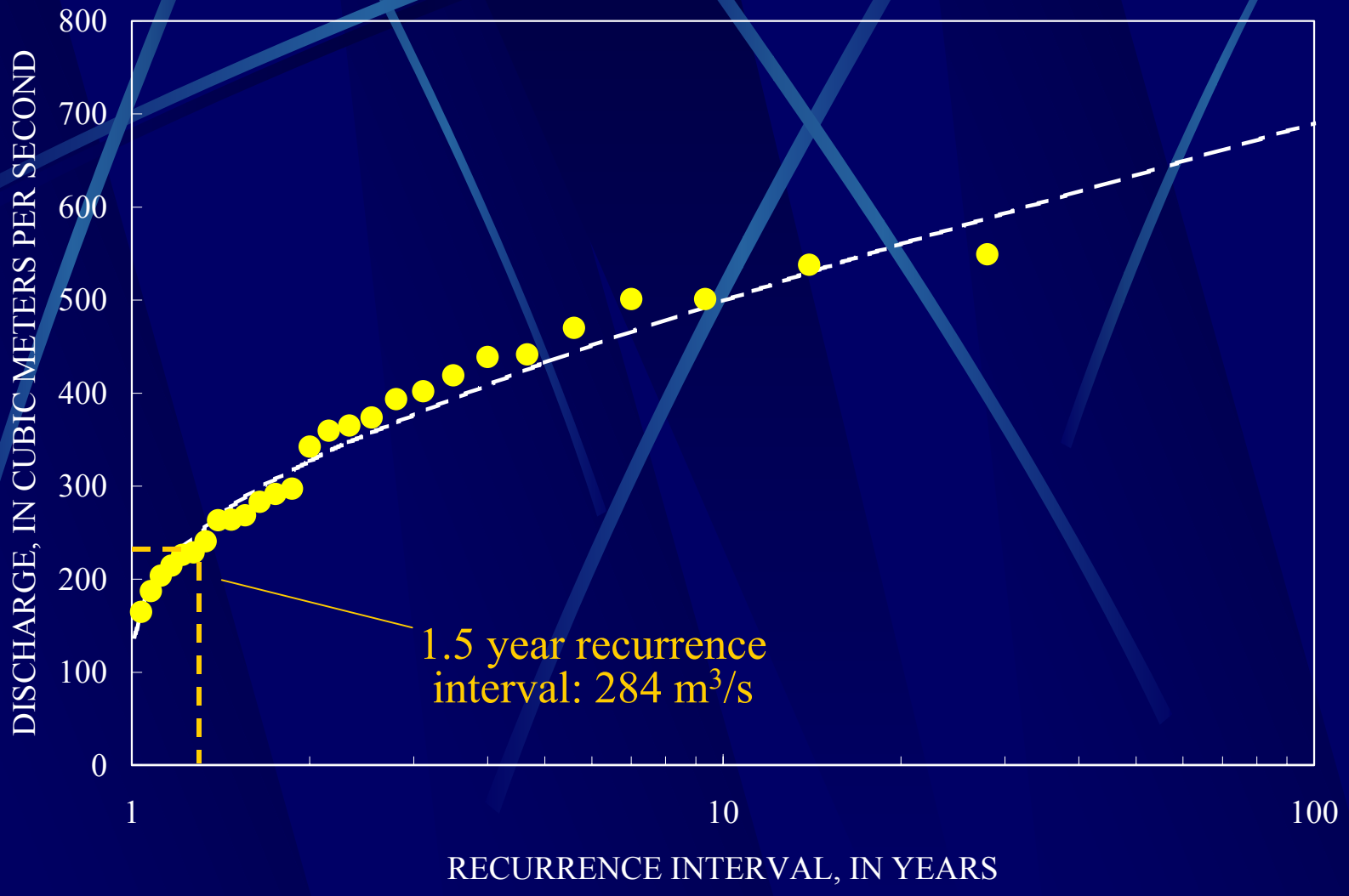
From Wolman and Miller, 1960.

Fig. 7.5 -- Effective discharge determination from sediment rating and flow duration curves.
In Stream Corridor Restoration: Principles, Processes, and Practices, 10/98.
Interagency Stream Restoration Working Group (FISRWG)(15 Federal agencies of the US).

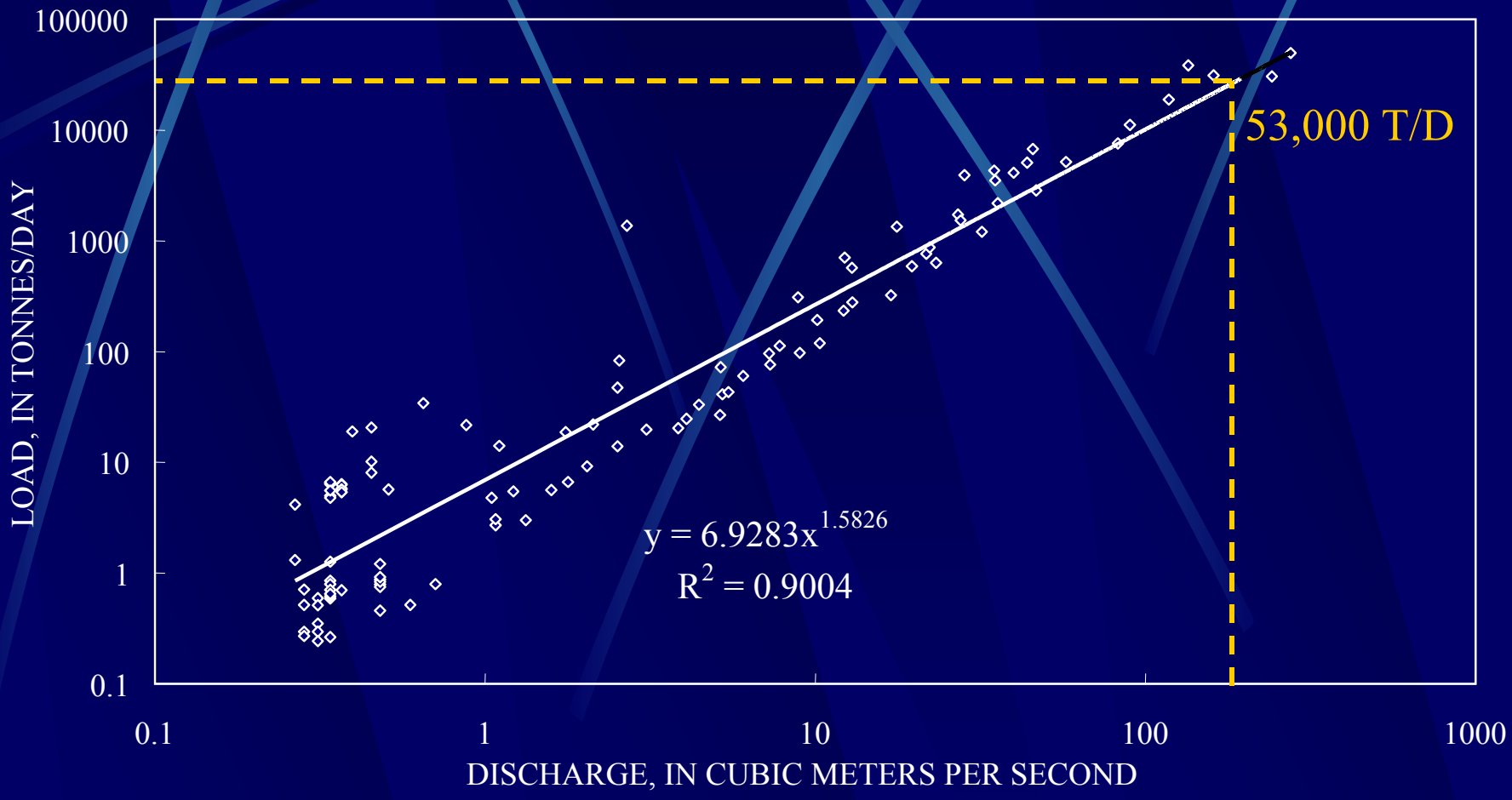
Ecoregions of EPA Region IX



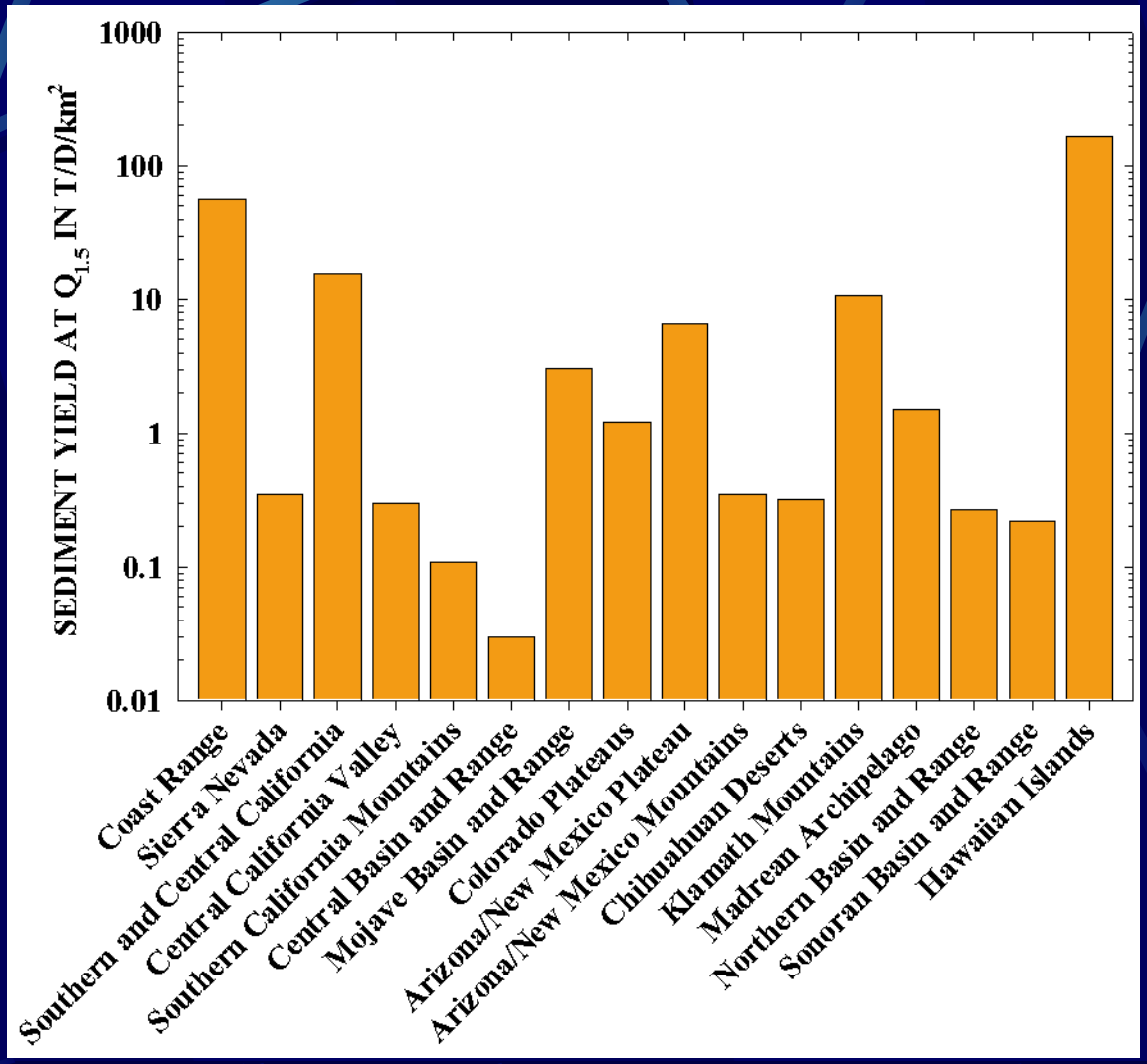
Calculation of Effective ($Q_{1.5}$) Discharge



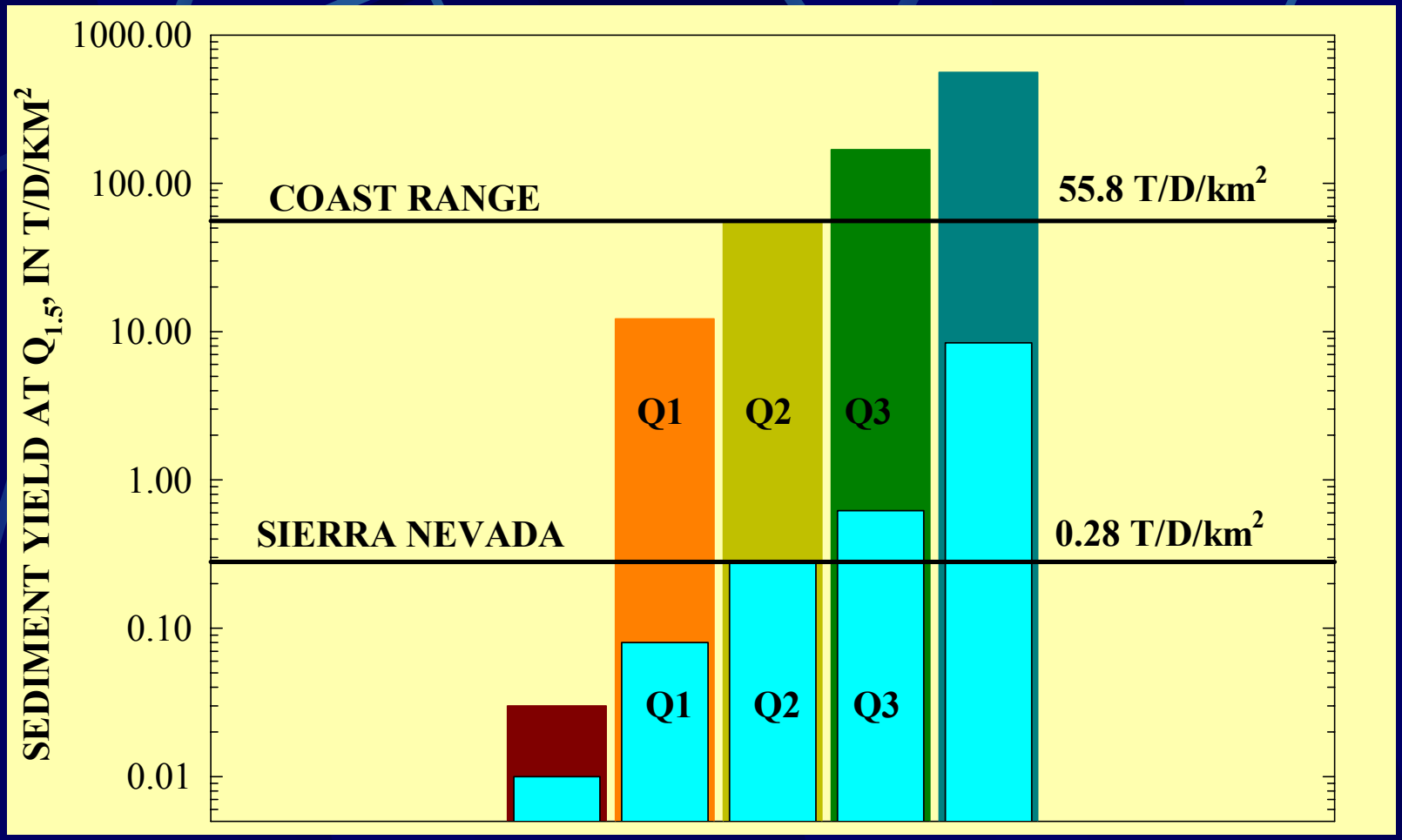
Sediment Load at $Q_{1.5}$



Range of Median Sediment Yields: EPA Region IX



Range of Effective Sediment Yields

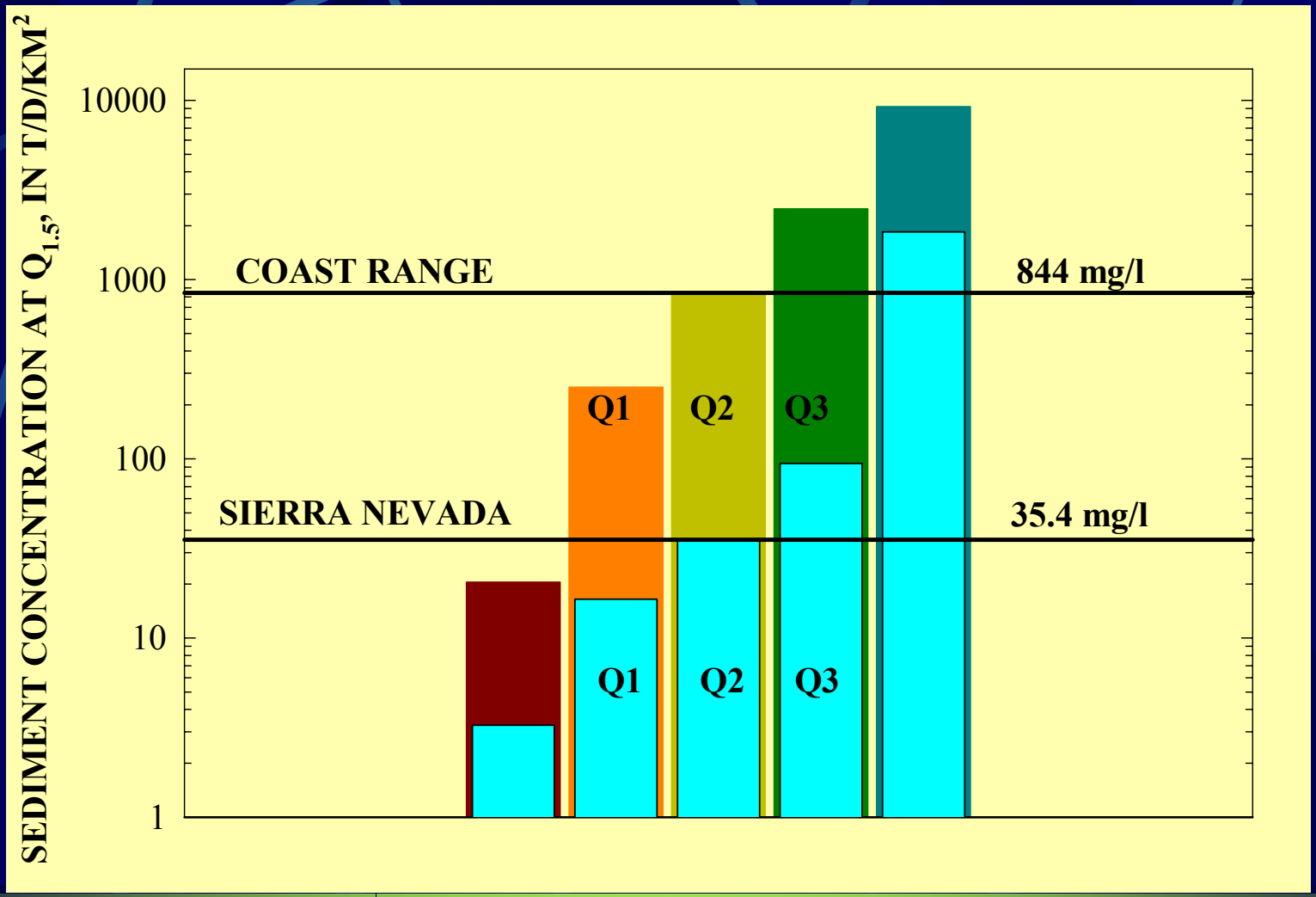


Very Preliminary Sediment Transport Estimates at $Q_{1.5}$ (High Rates)

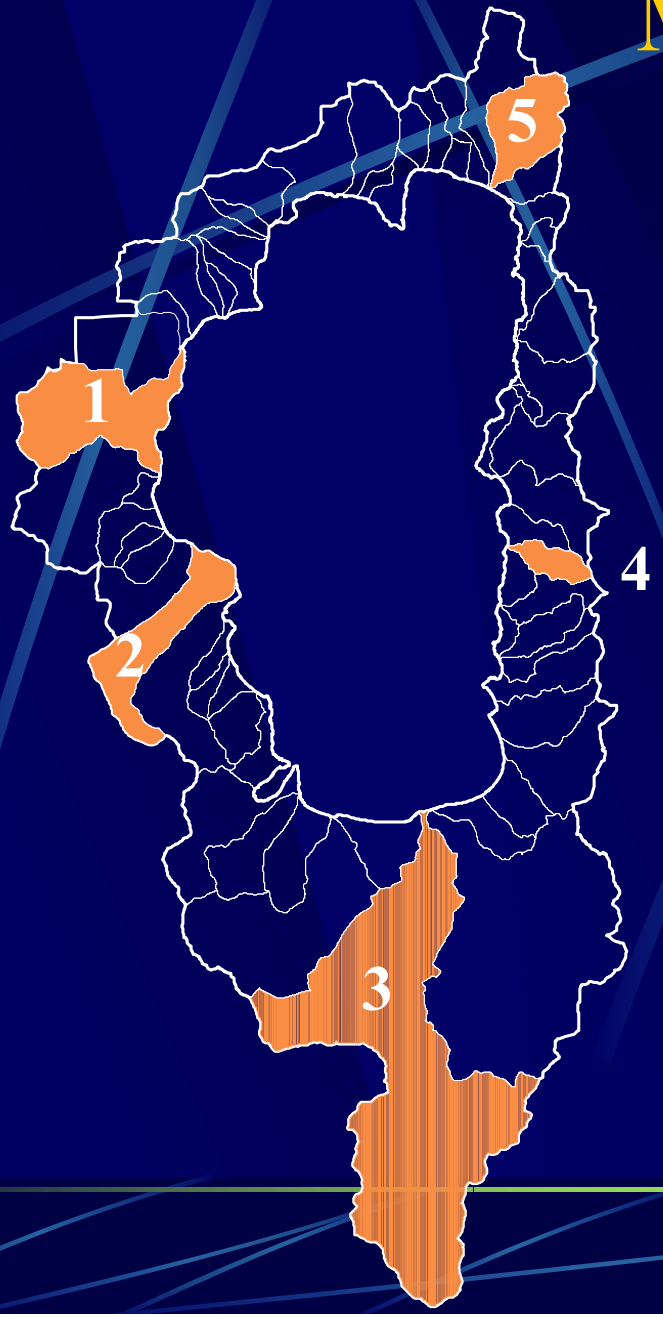
Load (T/D)	
Blackwood	118
Third Creek	116/44
Upper Truckee	59/55
Ward	52
Trout	38

Yield (T/D/km^2)	
Third Creek	10
Second Creek	8
Ward	6/2
Blackwood	4

Range of Effective Concentrations

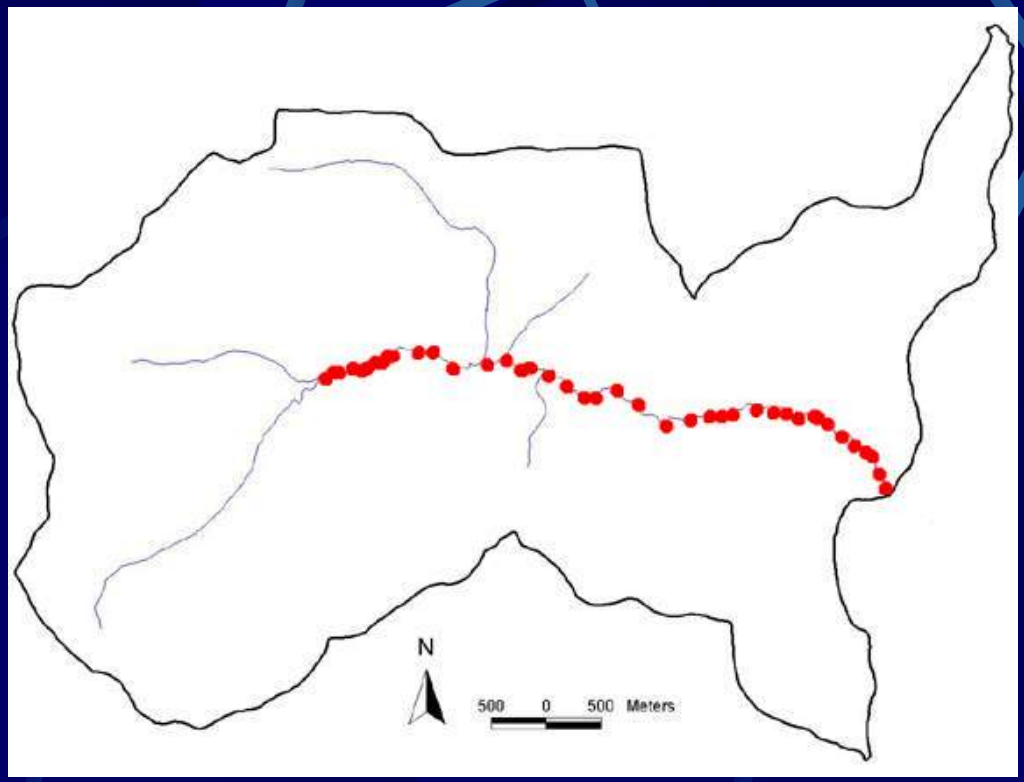


Basins for Watershed and Channel Modeling



1. Ward Creek
2. General Creek
3. Upper Truckee River
4. Logan House Creek
5. Incline Creek

Ward Creek



- 40 Surveyed cross sections
- Bed and bank-material samples
- Geotechnical testing

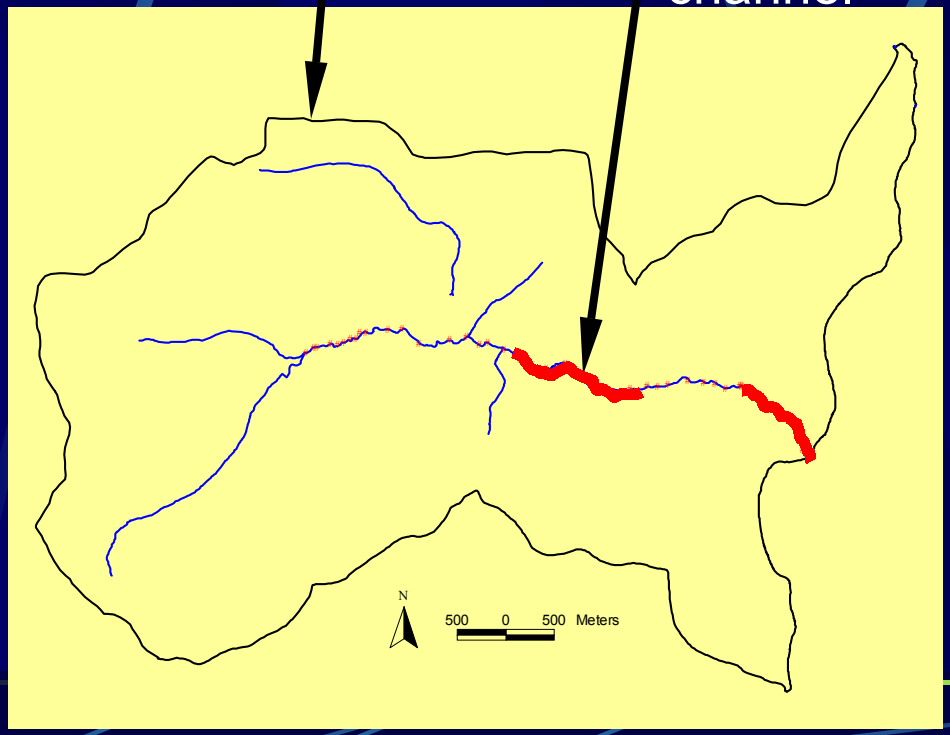
- RGAs and cross-section surveys

Channel Condition: Ward Creek

Reaches undergoing bank erosion

Watershed boundary

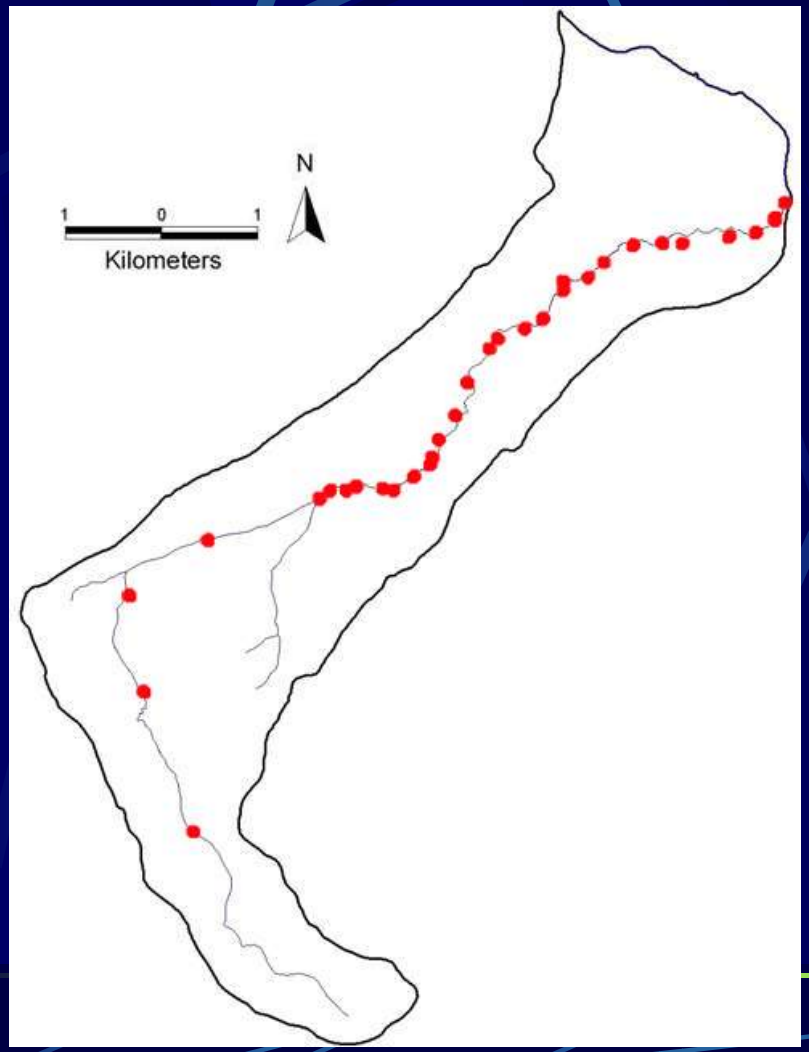
Stream channel



Typical cut bank along lower reach

General Creek

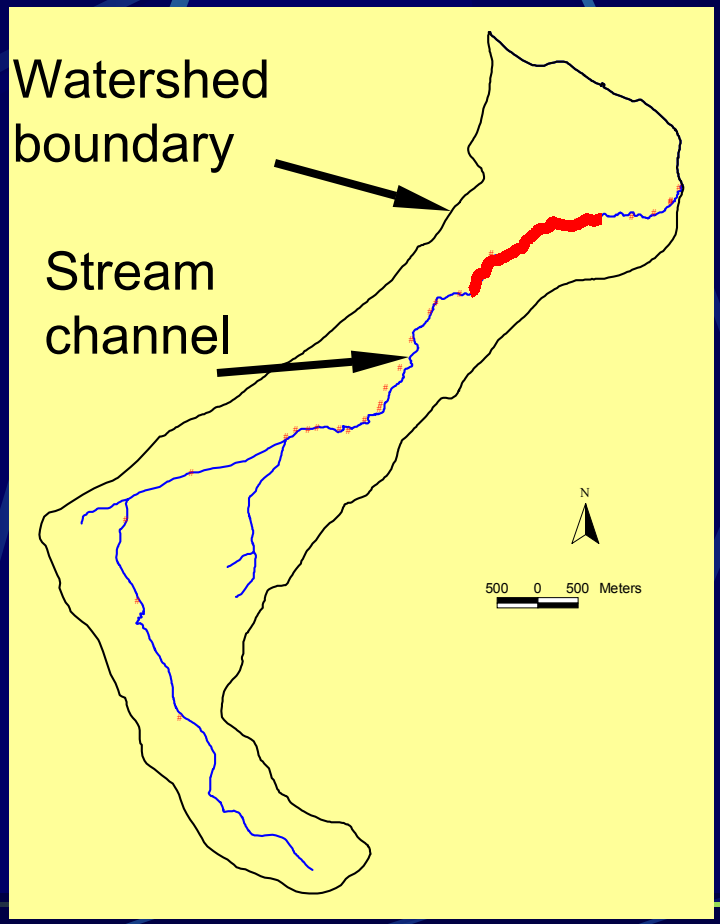
- RGAs and cross section surveys



- 31 Surveyed cross sections
- Bed and bank-material samples
- Geotechnical testing

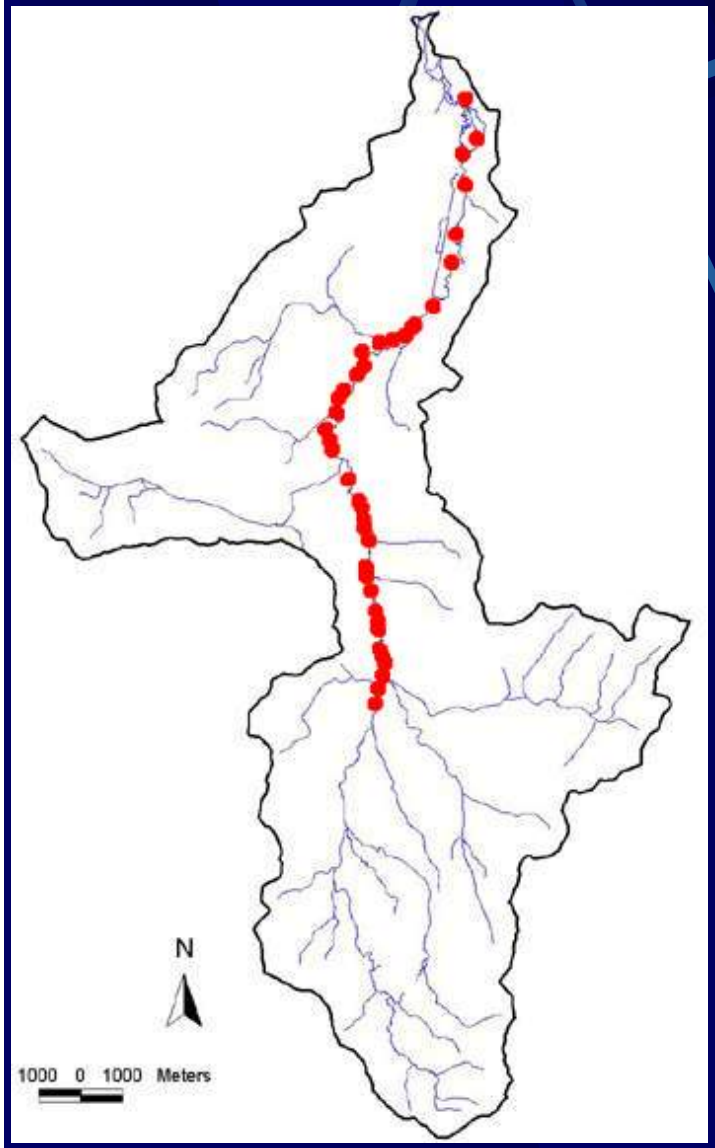
Channel Condition: General Creek

Reaches undergoing bank erosion

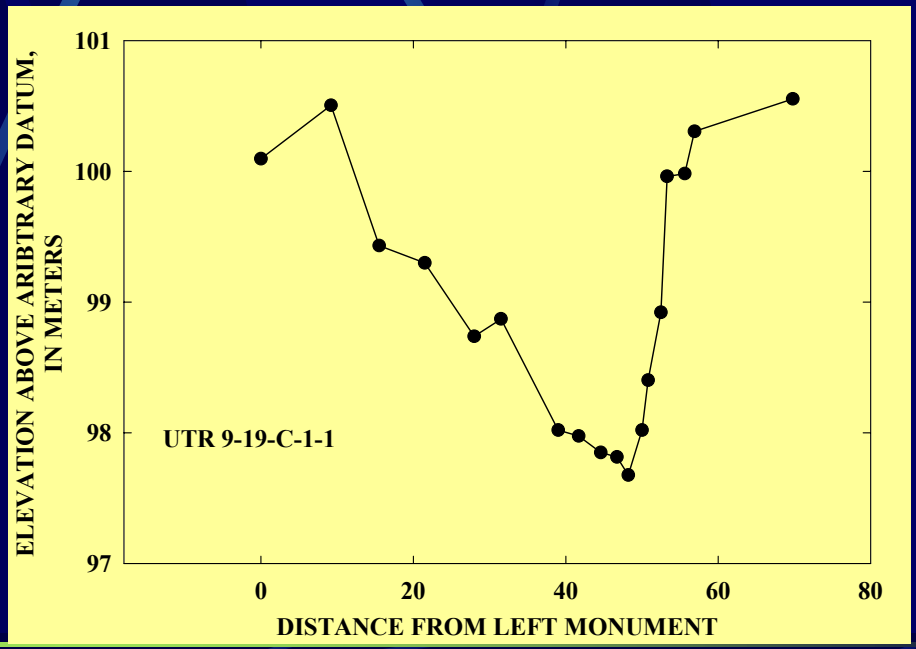


Typical cut bank along lower reach

Upper Truckee River

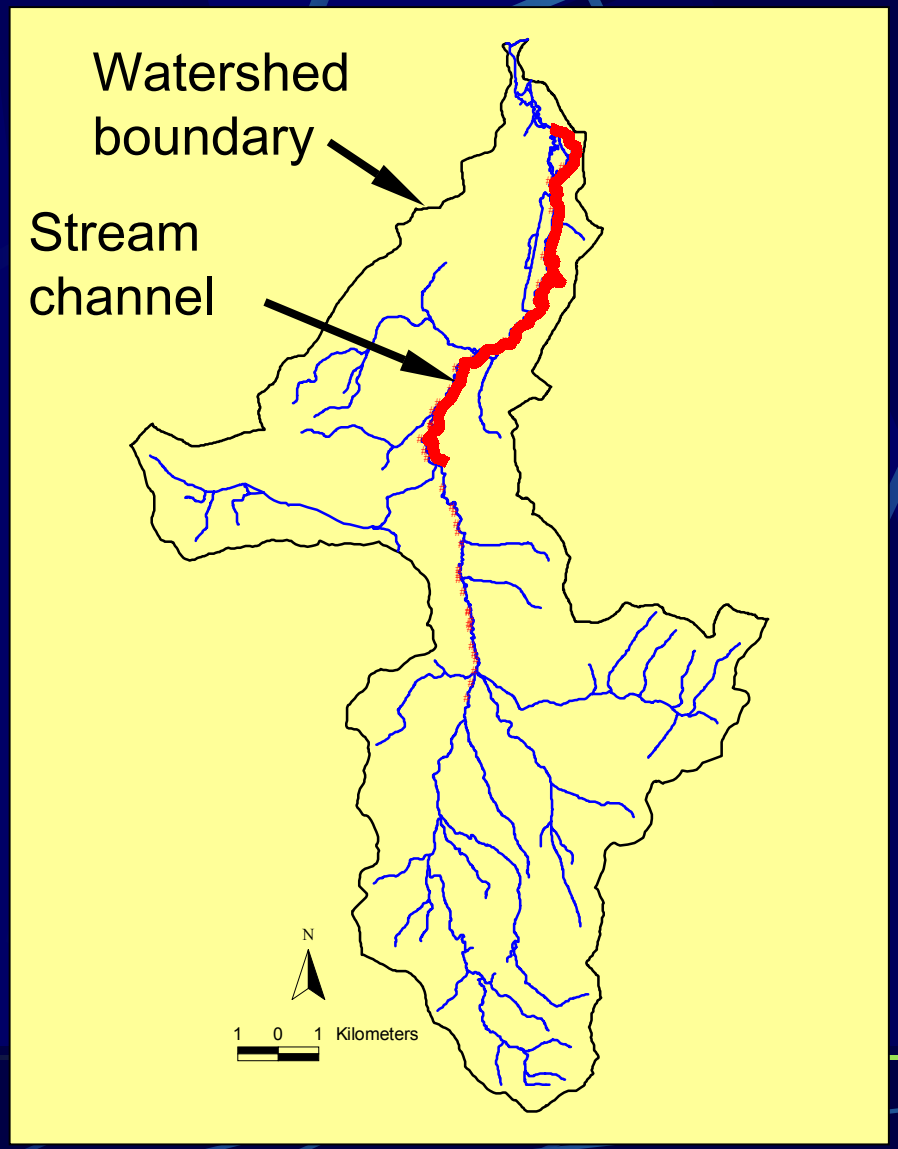


- 41 Surveyed cross sections
- Bed and bank-material samples
- Geotechnical testing



- RGAs and cross-section surveys

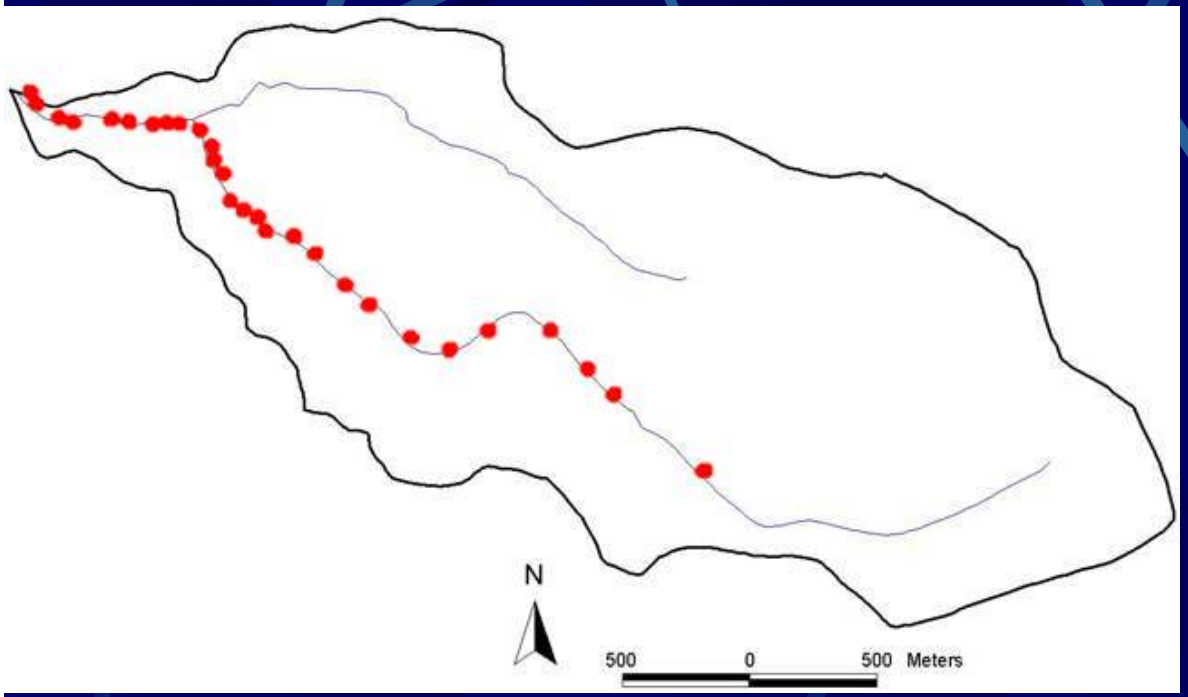
Channel Condition: Upper Truckee River



Reaches undergoing bank erosion

Typical cut bank along lower reach

Loganhouse Creek

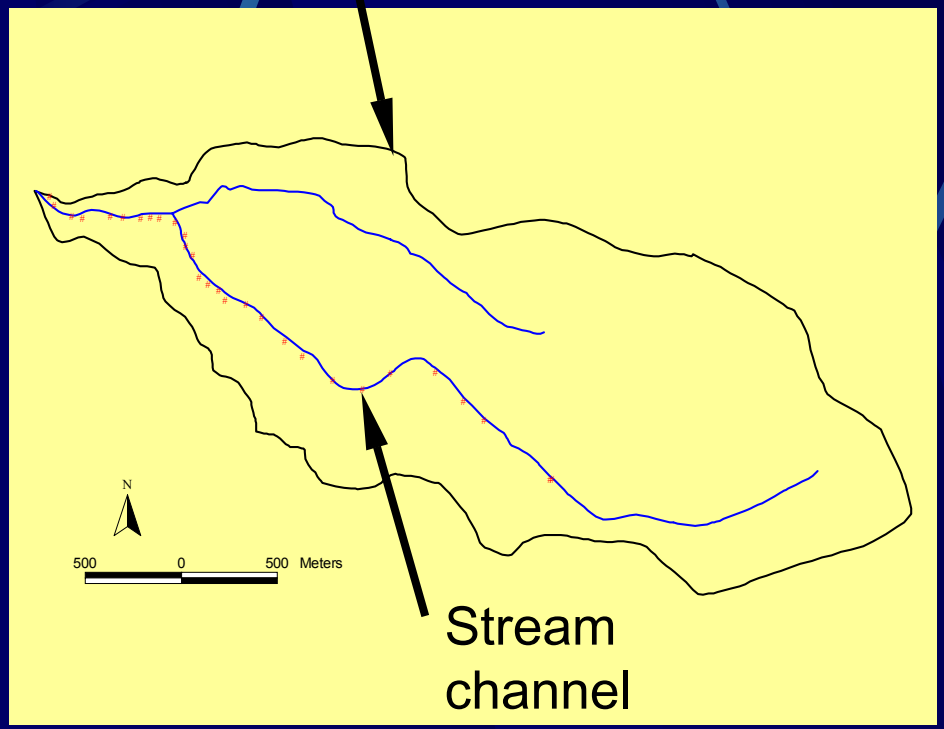


- 38 Surveyed cross sections
- Bed and bank-material samples
- Geotechnical testing

- RGAs and cross-section surveys

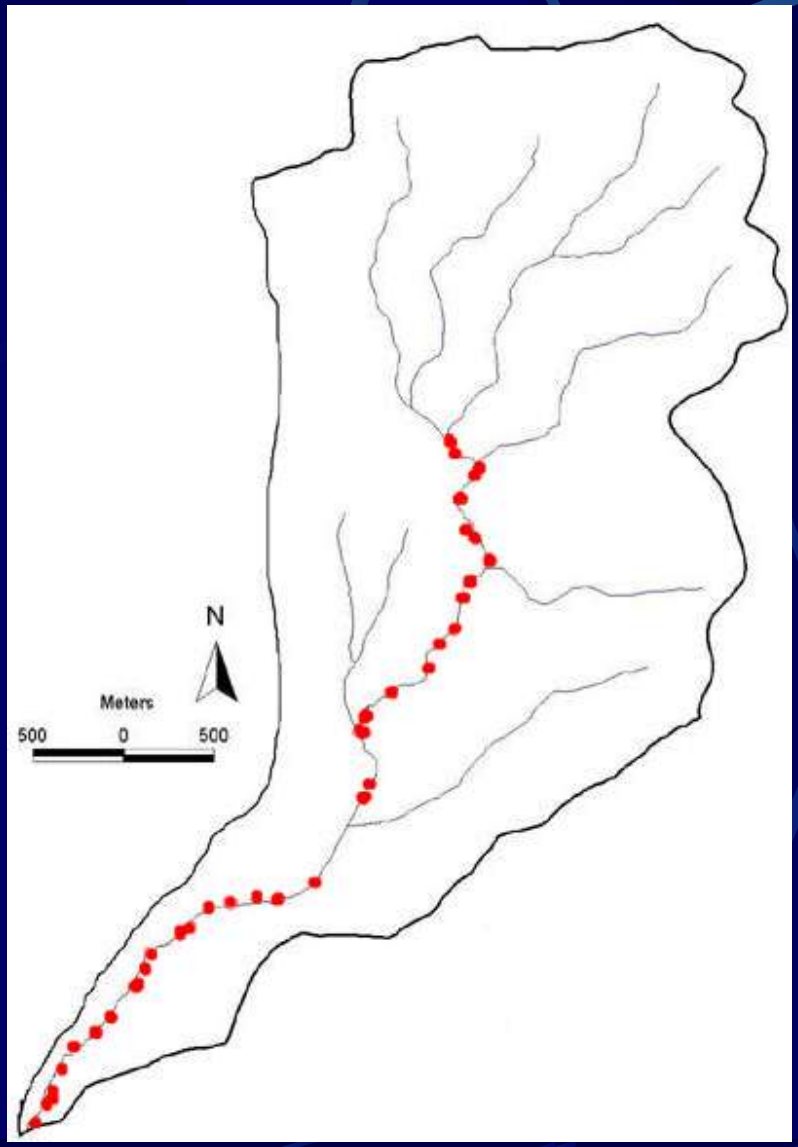
Channel Condition: Loganhouse Creek

Watershed boundary



Typical well-vegetated banks

Incline Creek

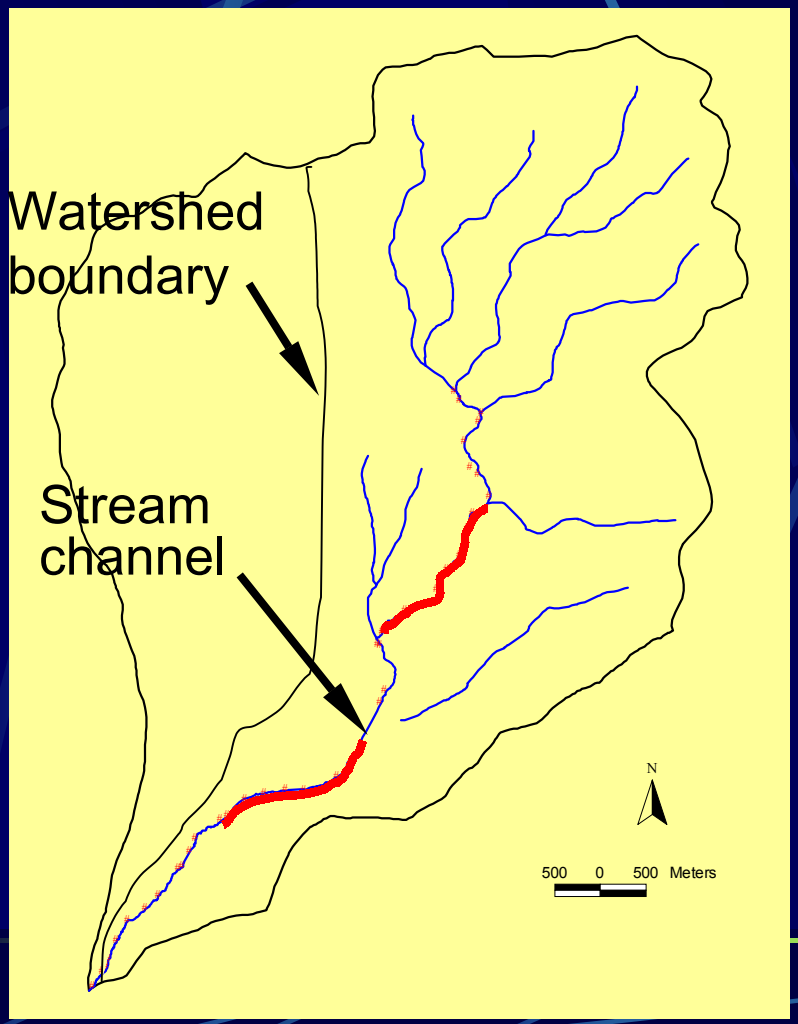


- 41 Surveyed cross sections
- Bed and bank-material samples
- Geotechnical testing

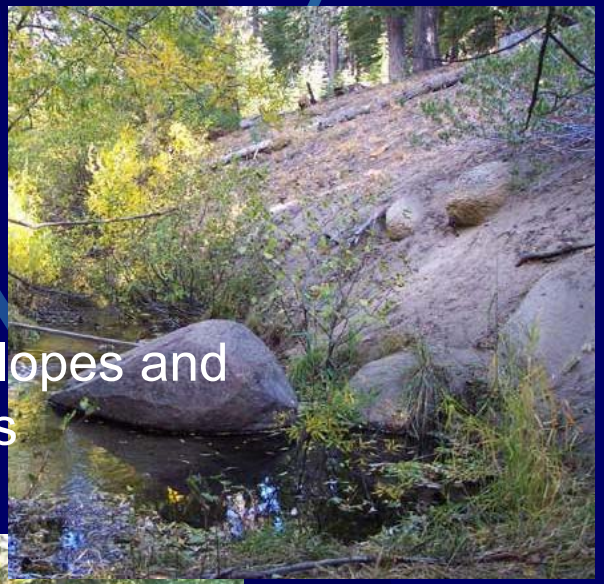
- RGAs and cross section surveys

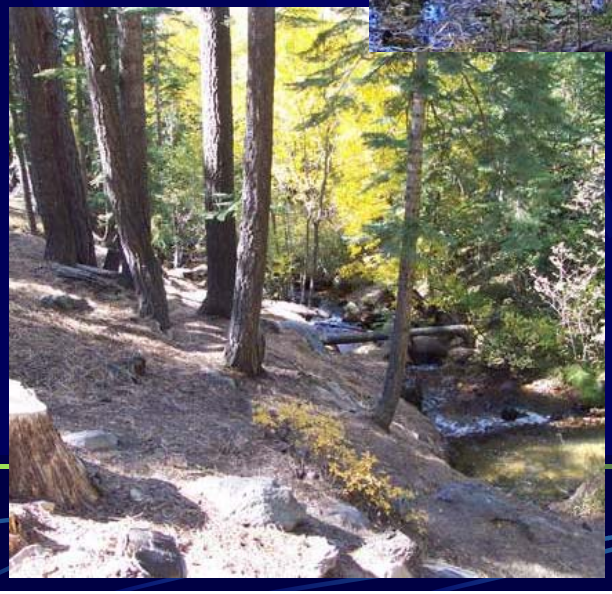
Channel Condition: Incline Creek

Reaches undergoing bank erosion

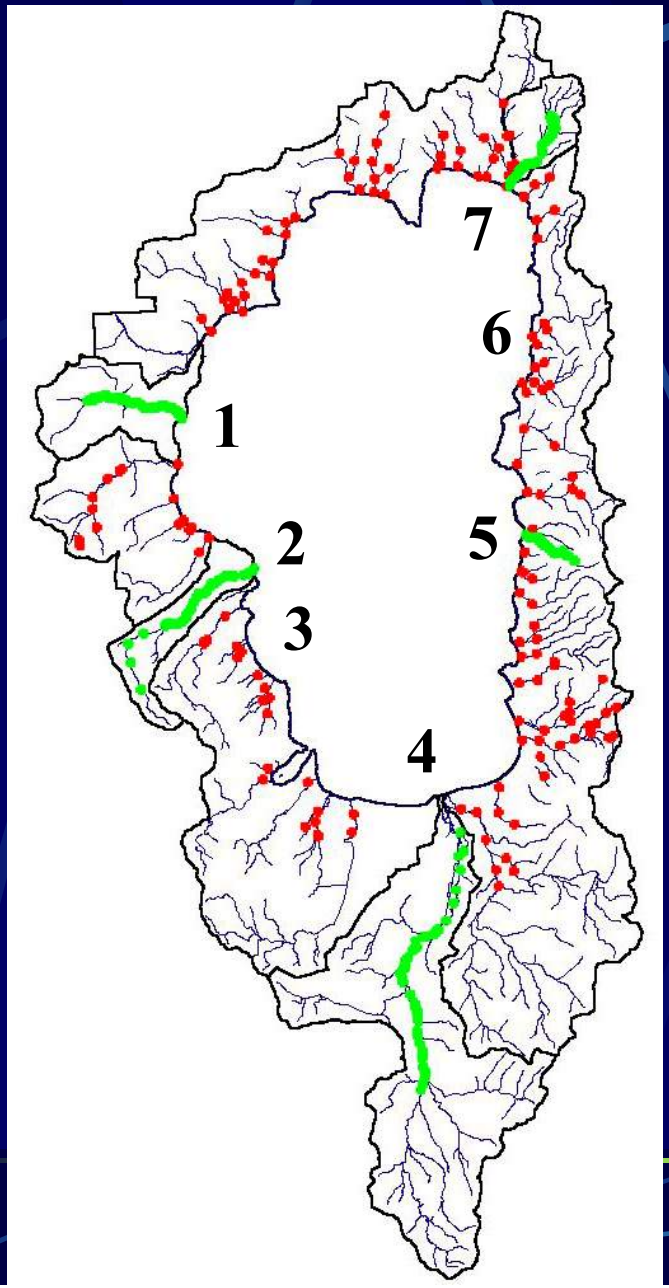


Typical bare slopes and banks





Detailed Surveying and RGA Sites



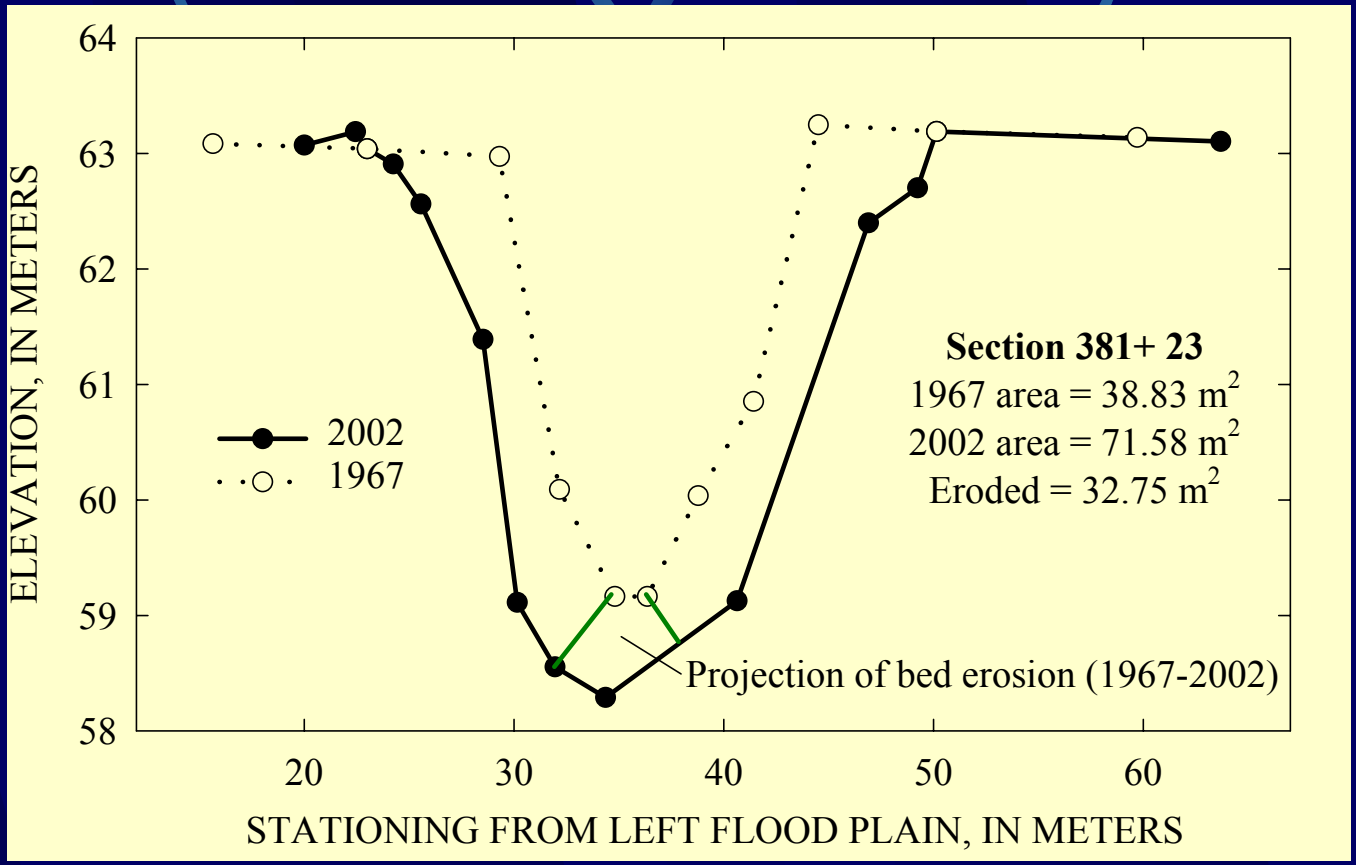
1. Ward Creek
2. General Creek
3. **Blackwood Creek**
4. Upper Truckee River
5. Logan House Creek
6. **Edgewood Creek**
7. Incline Creek

Matching 2002 with mid-1980's surveys
(Located about 95% of monuments)

Example of Contribution from Channel
(and contribution of fines)

88% Banks

12% Bed



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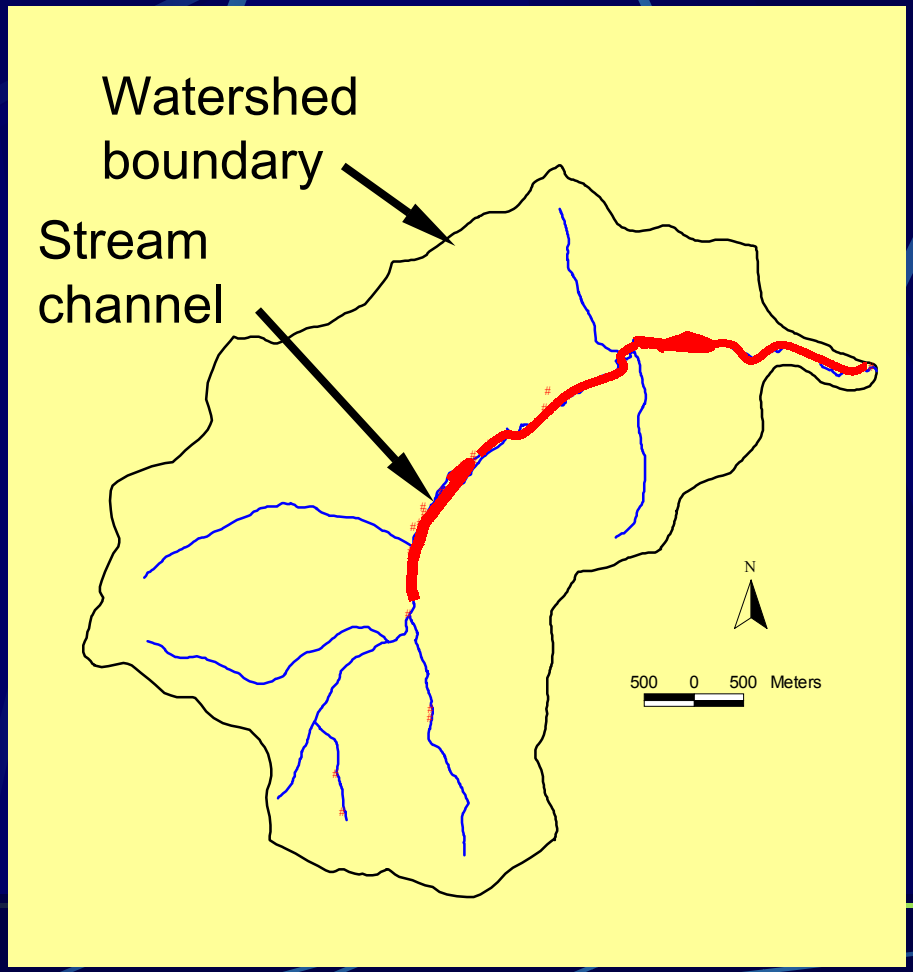
Channel Condition: Blackwood Creek

Reaches undergoing bank erosion



Cut bank along middle reach

Project Status as of December 2002
(*Work started in September 2002*)

- about 300 surveyed cross sections in 7 watersheds
- about 600 samples/particle counts of bed and bank material
- 125 samples analyzed for particle-size distribution
- about 150 geotechnical tests of streambank materials
- 25 erodibility tests of bank-toe materials
- Transport curves and flow frequency calculated for 38 sites in the watershed
- Distribution of suspended-sediment transport rates calculated for Sierra Nevada Ecoregion
- GIS layers obtained, analyzed and modified for AnnAGNPS modeling

Plans for Next Quarter (Jan. – March 2003)

- Determine means of sorting watersheds by characteristics and analyze differences in historical transport rates
- Work up all survey and geotechnical testing data
- Analyze all particle-size and unit-weight samples
- Obtain remainder of historical cross-section data
- Overlay historical with 2002 survey data and calculate channel contributions
- Assign geotechnical data to surveyed cross sections
- Input data into CONCEPTS
- Complete AnnAGNPS GIS work and validate flow simulations